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ABSTRACT

This paper presents an overview of the regulatory, technological, and economic status of interactive distance learning in Connecticut as it relates to the current and future provisioning of services by the telecommunications and cable television industries. The review is predicated upon the following questions: (1) What obligations should the company assume regarding educational equipment and what costs commensurate with outside distribution plant should be the operator's responsibility? (2) What equipment and distribution plant should schools and municipalities themselves be responsible for providing? (3) To what extent and in what manner should the various educational programming costs be allocated? (4) How can both local exchange companies, interexchange carriers, and cable franchise operators best serve the state's educational technology needs, particularly in a newly competitive telecommunications environment? Connecticut has a unique approach to the social question of provisioning the distance learning equipment necessary for educational programming, production, and origination, including essential classroom equipment, personnel, and in-school support services in terms of responsibility of both the local educational entities and the concomitant responsibility of a government agency such as the state's Department of Public Utility Control. The Department's most appropriate function is to balance both the degree of support provided by the telecommunications and cable industries to avoid effectuating monopolist control over educational services so as best to provide for the public good. Maps and diagrams are appended. (Author/BEW)

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Regulatory Enhancements, Infrastructure Modernization, and Connecticut's Interactive, Distance Learning Network

Paper Presented at the 1996 *CABE* Educational Technology Conference
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Waterbury, Connecticut
January 4, 1996

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ABSTRACT

Regulatory Enhancements, Infrastructure Modernization, and Connecticut's, Interactive, Distance Learning Network

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The purpose of this paper is to present a comprehensive overview of the regulatory, technological, and economic status of the state of interactive distance learning in Connecticut relating to the current and future provisioning of these services by the telecommunications and the cable television industries, respectively. The review is predicated upon the following questions:

1. What obligations should the company assume regarding educational equipment and what costs commensurate with outside distribution plant should be the operator's responsibility?
2. What equipment and distribution plant should schools and municipalities themselves be responsible for providing?
3. To what extent and in what manner should the various educational programming costs be allocated?
4. How can both local exchange companies, interexchange carriers, and cable franchise operators best serve the state's educational technology needs, particularly in a newly competitive telecommunications environment?

The paper goes on to examine Connecticut's unique approach to the social question of provisioning the distance learning equipment necessary for educational programming, production, and origination, including essential classroom equipment, personnel, and in-school support services in terms of responsibility of both the local educational entities and the concomitant responsibility of a government agency such as

the state's Department of Public Utility Control. The paper takes the position that the Department's most appropriate function is to balance both the degree of support provided by the telecommunications and cable industries to avoid effectuating monopolist control over educational services so as to best provide for the public good.

INTRODUCTION and BACKGROUND

On June 10, 1993, Connecticut' s governor signed into law legislation mandating a feasibility study to be conducted to assess to what extent and in what manner bidirectional, full-motion educational programming may best be effectuated among the state's 26 cable franchise operators.[1] This legislation coincided with such federal remote educational initiatives as the National Competitiveness Act of 1993 and the Distance Learning Information Act of 1993. On February 1, 1994, Connecticut's Regulatory Utility Agency, the Department of Public Utility Control (DPUC or Department) submitted a comprehensive report to the Connecticut General Assembly adumbrating the feasibility of a statewide interconnection among the state's cable franchise operators for the purposes of facilitating instructional programming.[2] The purpose of the federal legislation is to establish a national clearinghouse for information technologies. The clearinghouse will maintain a database of distance learning protocols, report on the completion of successful projects, periodically publish a compilation of reports, and review grant applications.[3] Public Act No. 94-83, signed into law on July 1, 1994, *An Act Implementing the Recommendations of the Telecommunications Task Force,* allowed 2-way, interactive transmission for the limited purposes of supplying educational cable programming by the state's cable franchise operators, and addresses the following concerns:[4]

1 Application of Storer Communications of Clinton, Inc., for Franchise Renewal. New Britain, CT.:An Act Concerning Educational Community Antenna Television Service. Hartford, CT.: Substitute Senate Bill No. 414, June 10, 1993.

2 DPUC Feasibility Study of Provisioning of Bi-Directional Transmission of Educational and Instructional Programming. New Britain, CT.: Dept. of Public Utility Control, Docket No. 93-07-09, January 26, 1994.

3 Telecommunications and Information Infrastructure and Public Assistance Act of 1993. Washington, D.C.: H. R. 2639, July 14, 1993.

4 Substitute House Bill No. 5420: Public Act No. 94-83, An Act Implementing the Recommendations of the Telecommunications Task Force. Hartford, CT.: July 1, 1994. 33 pp.

1. What obligations should the franchise operator assume regarding educational equipment and what costs concomitant with outside plant should be the cable franchisee's responsibility?
2. What equipment and distribution plant should the schools be responsible for?
3. To what extent and in what manner should inter-franchise instructional programming costs be allocated?
4. How can local exchange carriers (LECs) best meet the state's educational technology needs?[5]

Technological innovations by the state's cable franchise operators have been analyzed by the Department, some of which have been initiated by the major cable players. Tele-Communications Inc., (TCI) for example, the world's largest multiple systems cable franchise operator (MSO), currently owns and operates five franchises in Connecticut, and has installed fiber-to-the-feeder trunking cable, increasing channel capacity and improving picture quality and adding laser quality sound. This innovation also facilitates reception of a single signal within the franchise area transmitted to an individual town rather than having that signal be received by all other franchise area towns, thus skirting contentious privacy issues. The advantage is that the distance learning transmissions need not block dedicated public, educational, and governmental access channel times in franchise area municipalities. With a dedicated channel, the interactive educational transmissions may be viewed by interested franchise area subscribers.

An amorphous area in distance education is cost allocation for the various interactive distance education protocols. Educational costs have been largely supported by the general tax base, and within franchise areas, by the company's general rate base of subscribers. However, the costs for each type of remote educational morphology vary with network configuration and with concomitant engineering requirements. The incipient federal legislative framework supporting distance education is generally silent on the question of cost and rate base implications

5 Brigette Greenberg, "SNET, AT&T are Competing for Classrooms," The Day, (December 6, 1995): D1, D4.

for remote educational infrastructures, and recent federally initiated rate changes do not generally address the financial impacts of institutional networks. The legislation states in part:

> to achieve significant cost savings and improved distance learning services by establishing....an "information clearinghouse" for distance learning activities to gather and distribute information on the effectiveness of distance learning programs and the technologies used in such programs.[6]

As far back as 1988, the Connecticut State Board of Education and the Board of Governors for Higher Education surveyed Connecticut's cable franchise operators on the uses of instructional programming on educational access channels by schools and on schools' perceptions regarding inhibiting factors in the instructional uses of cable.[7] Results indicated that while the use of instructional channels by educational institutions at that time was relatively low, both teachers and administrators were becoming increasingly aware of the need of sharing video resources among schools within educational districts. One recommendation from that survey stated that the Department of Higher Education should: "Offer technical and financial assistance to schools for the wiring of school buildings...."[8] A recent DPUC-authorized study on the feasibility of a statewide distance learning interconnected network found that teachers overwhelmingly stated they would not be averse to teaching via some type of interactive television protocol.[9] Generally speaking, distance learning costs are considered to be "above the line"; that is, they are not directly included in the regulated entity's (SNETCO) rate base and thus are directly paid by shareholders. However, since the funds that support remote education are generated by the regulated, money-making subsidiary of the parent Company (SNET), the ratepayers may be said to indirectly pay for the various distance learning costs, and thus serve the public good.

6 Distance Learning Information Act of 1993. Washington, D. C.: H. R. 2592, July 1, 1993

7 Richard T. Hetzel, Utilization of Mandated Instructional Access Cable Channels in Connecticut. Syracuse, New. York., March 4, 1988. p. 9.

8 Communications Policy Group: Cable Television Community Needs Assessment :Final Report to the DPUC. New Britain, CT.: Docket No. 90-10-11, Application of Century Cable Management Corp. for Franchise Renewal, Appendix C. October 5, 1992, p. 5.

9 DPUC Feasibility Study of Provisioning of Bidirectional Transmission of Educational and Instructional Programming, Docket No. 93-07-09. New Britain, CT.:Department of Public Utility Control, November 18, 1992, pp. 6-8.

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The DPUC has been actively addressing the issue of remote educational protocols for about five years, and has evolved the position that franchise operators need commit to the provisioning and to the maintaining of technologically advanced equipment and facilities for effectuating educational programming, and should incur some of those expenses that are legitimately needed to transmit such programming. The Valley Shore Telecommunications Cooperative, an educational consortium comprised of six school systems along the state's shoreline, has advocated, for example, that cable operators interconnect franchise areas so that educational programming can be shared across cable franchise boundaries. According to Valley Shore, "Not only must our school walls come down and become almost limitless, but so too should the walls of our franchise areas."[10] The Department submitted to the General Assembly draft legislation concerning two-way transmission of cable signals. The legislation, enacted in 1994, allowed cable operators to transmit bidirectionally, as cable franchisees are currently restricted statutorily from 2-way transmission, (1.) "....the one-way transmission to subscribers of video programming or information....to all subscribers generally...."[11] The language was changed in 1994 to allow cable operators to transmit bidirectional educational programming relative to operators' franchise agreements. The proposed language, as promulgated by *Public Act 94-83* states that instructional and educational programming will consist of:

The two-way transmission of educational and instructional programming or information to a public or private elementary or secondary school, or a public or independent institution of higher education....[12]

The new language will be codified into the state's *General Statutes* in 1996.

10 DPUC Feasibility Study of Provisioning of Bidirectional Transmission of Educational and Instructional Programming, Docket No. 93-07-09: Comments of the Valley Shore Telecommunications Cooperative. New Britain, CT.: Department of Public Utility Control, September 30, 1993. pp. 1-3.

11 General Statutes of Connecticut, vol. 5 Titles 14-16a. Revised to January 1, 1995. Hartford, CT.: pp. 441-442.

12 An Act Implementing the Recommendations of the Telecommunications Task Force. Hartford, CT.: Public Act No. 94-83, July 1, 1994. p. 6.

STATE REGULATORY ENHANCEMENTS

This change in regulatory policy, first proposed by the Department in 1993, is consonant with the general issue of interconnectivity of instructional or of institutional networks across Connecticut's cable franchise demarcations. Specific apportionment of distance education costs was not specifically addressed in the Department's 1994 report to the General Assembly, and distance education costs are acknowledged to be unique to the specific system architecture of each cable operator. Connecticut's regulators have historically taken the position that cable franchisees have a social contract obligation to supply the distribution plant and some of the funding necessary for remote educational programming. Legally, these costs are ostensibly interpreted as rate-based above-the-line pass-through costs to subscribers, as stated in the 1992 Cable Act:

the cost of satisfying franchise requirements to support public, `educational, or governmental channels....and the costs of any public, educational, or governmental access programming.... are largely beyond the control of the cable operator and should be passed on to subscribers without a cost-of service showing.[13]

Recently enacted legislation has stated that each cable franchise operator:

....shall make available....all equipment and services necessary to provide the two-way transmission of educational and instructional programming....unless the Company receives a waiver for good cause from the Department of Public Utility Control."[14]

A social contract/alternative form of regulation, such as the type used in the offering of remote education, generally requires a subsidy in order to provide the service, in this case a remote learning protocol, that in itself, may be uneconomic to offer since it is revenue neutral per se; hence the need for a surplus or a dedicated fund to provide a financial basis for offering the service. This regulatory scheme also allows for separation between rates and the company's costs of providing its services. Other companies offer remote educational protocols through retained or overearnings, such

13 DPUC Feasibility Study of Bidirectional Transmission of Educational and Instructional Programming: Comments of the New England Cable Television Association, Inc. New Britain, CT.: Department of Public Utility Control, Docket No. 93-07-09, September 30, 1993. p. 10.

14 An Act Concerning Educational Community Antenna Television Service-Proposed Substitute Language to Committee Bill 414. Hartford, CT: March 25, 1993.

as a market trial for a developing service that might be proffered in selected franchise towns. In Connecticut, remote education costs are generally considered to be unregulated services, as is public, educational, and governmental access programming. Additionally, the public, educational, and governmental institutions themselves incur costs, part of the recovery of which could theoretically be derived from the general tax base of the affected franchise towns, various embedded subsidies, off-budget funding schemes, private investment, or more specifically, from incipient competition, both in the cable and telephone industries. The construction of a distance learning architecture may be considered an operating expense by the franchisee, and thus be charged to the subscribers, since that function then becomes another operating cost of providing service. Further muddying these cost allocation waters is the nascent appearance of the competitive access service providers, (*CAPS*) some of whom may eventually offer the local access programming functions for the cable operator.

Additionally, distance learning architecture will help expand educational choices and operationally will extend the reach of education deeper and more substantively into the temporal lives of learners. In Connecticut's case, preliminary and unofficial rough cost estimates for statewide interconnectivity are approximately $71,168,123, which is about $6.17 per subscriber per month in addition to whatever each customer currently pays for his extant level of service. Cable operators estimate they have spent over $23,000,000 dollars on distance education, with the advent of educational programming rules, and further forecast that the costs to interconnect remote educational architecture with other operators would be much greater, due to the prodigious amounts of fiber optic cable and the concomitant electronics that would be needed to bring the feed into the home.[15] When added to the average monthly cost for basic cable service, it becomes apparent that a statewide interconnected cable institutional network may significantly increase the cost of basic cable television service, especially for the upper tiers of service, if, as anticipated, cable rates are once again deregulated in the near future.[16] Additionally, there is the reality of local loop telephone competition, which

15 DPUC Feasibility Study of Bidirectional Transmission of Educational and Instructional Programming: Unpublished Preliminary Cost Estimates. New Britain, CT.: Department of Public Utility Control, Docket No. 93-07-09, November 1, 1993.

would facilitate the eventual merging of the telecommunications, computer, and the cable industries, further complicating the issue of cost allocation and the general issue of who pays for what services. Additionally, interest in interactive television has ostensibly flagged, due to the tremendous popularity of the Internet, and the daunting costs for provisioning a complete video and telephone interactive system, estimated by experts to be around $17,000. Lastly, there is the thinking by some utility regulators that the public service commissions should promote distance education systems not only to benefit franchise area schools, but also to benefit other subscribers, since the construction of the remote educational network makes that plant available for other public service uses as well, such as telemedicine, video-on-demand, interactive games, interactive libraries, and for communications infrastructure modernization. If telephone and cable companies do not assume the responsibility for constructing distance education networks, the "critical mass" of money from the communications infrastructure that the operator uses to provision its panoply of services, particularly the enhanced or specialized features, will be minimized.[17]

The possibility of a "superinfostructure" revitalizing recession-wracked economies such as in Connecticut is appealing. New legislation has mandated the beginning of intrastate interexchange and local loop telephone competition, which may spur the development of institutional networks. Maugre the dawning of the Information Age, it is estimated that even today one of four adults has never used a computer or has never programmed a VCR to tape a television show. Over the past five years, tens of thousands of manufacturing jobs have disappeared in Connecticut. Since 1970, the number of blue collar workers has declined by nearly 75 percent, and the workforce has changed from manufacturing and industry to primarily information processing.[18] In Connecticut debate is presently heating up as a neophyte cable franchise operator, FiberVision Corp., has charged the state's dominant local exchange carrier, Southern New England Telephone, (SNET) with using a video services trial to preclude FiberVision from beginning its own cable programming operations. FiberVision has proposed its own interactive distance learning network linking schools in its franchise area, and that scenario remains to be played out in the courts.[19]

16 "Using Distance Learning tc Push Telco Deregulation," Distance Education and Cable Television, 1, (2), (December, 1992): p. 5.

17 Howard Gross, "Despite the Hype, There are Roadblocks on the Way to the Superhighway," The Hartford Courant, (February 27, 1994): D1, D4.

18 Anthony Giorgianni, "Cable Competitor Questions Nature of SNET's Video Service Test," The Hartford Courant, 156, (40), (February 9, 1994): B11.

STATE VIDEO DIAL TONE TRIALS

SNET's video dial tone trial will include such potential services as interactive remote education via Asynchronous Digital Subscriber Line technology, and Asynchronous Transfer Mode, which allows the delivery of video programming over traditional copper telephone lines.[20] Additionally, SNET is constructing its own statewide institutional, fiber optic network called *I-SNET*. This will be an interactive, multi-media, all-digital, all-fiber-optic network bringing an entire developing generation of information and educational services to all Connecticut residential and business customers. *I-SNET* will cost an estimated $4.5 billion and is expected to be completed over 15 years.

In addition to educational uses, other applications include telemedicine via high-definition video monitors, and international teleconferencing.[21] On the cable front, Time Warner Cable recently delayed its 4,000 home trial of interactive cable television, attributing the delay to manufacturing problems of the software designed to run the set-top boxes that transmit the interactive computer graphics. Said Edward R. McCracken, Silicon Graphics Chairman, "This is hard stuff. This is supposed to look like a television set even though its actually a sophisticated computer network."[22] Regarding the statewide interconnection, there is a weighty legal issue of local access with which to contend. For example, to what extent would a "must carry" type of designation for instructional programming oppose the intent of the federal government that such transmissions be dedicated specifically for local access purposes? The Department has only gone so far as to rule that:

it is the responsibility of a cable operator to address the educational needs within its franchise through the provision of facilities and equipment necessary for technologically advanced educational programming, where such needs have been identified as an essential part of the overall cable-related community needs.[23]

19 Application of the Southern New England Telephone Company to Test a New Technology in Providing Video Dial Tone Service. Washington, D.C.: FCC, April 27, 1993.

20 I-SNET: Introducing Connecticut's Information Superhighway. New Haven: Southern New England Telephone.

21 John Markoff, "Time Warner Delays Trial of Interactive TV System," The New York Times, 143, (49,623), (March 2, 1994): D1, D5.

22 Application of Storer Communications of Clinton, Inc., Inc., for Franchise Renewal. New Britain, CT.: Department of Public Utility Control, Docket No. 90-06-23, November 18, 1992. p. 6.

The Department's historical philosophy regarding distance education has generally been delimited to focusing on the educational needs of the educational communities of interest within the parameters of governmental influence on public access programming. That view has remained essentially the same in the recent report to the state legislature, with the regulatory emphasis being on ensuring that the franchise operator offers whatever services are considered necessary and appropriate by the franchise community, though not at the expense of offering reliable cable service to its extant subscribers.[24]

CONNECTICUT'S REMOTE EDUCATIONAL CABLE PROGRAMS

As Connecticut's cable operators have begun to implement remote education, equipment provisioning has been varied. Typically, distribution equipment has included return lines both upstream and downstream, connecting distance education studios, hardware, internal wiring, fiber optic technology, modulators and demodulators, and various components of the outside plant. Companies have also offered technical expertise concomitant with the hardware. Equipment supplied by schools has typically included whatever plant is necessary to effectuate program origination. Educational programming costs have been included in basic rates; however, due to the treatment of those expenditures, specific rate base impacts have not been isolated and analyzed, particularly under the often confusing proliferation of the recent cable rate reregulation laws. About 14 of the state's cable operators have implemented some type of remote educational protocol or are in the process of constructing one.[25] According to the Joint Committee on Educational Technology, (JCET), a technical standing group of education professionals charged with reporting on the various uses of educational technology, Connecticut lags far behind many other states technologically with respect to distance education provisioning.[26] Remote learning, until the relatively recent explosion in information technology, has had the same basic configuration for over 20 years-a talking teacher positioned in front of a camera. New interactive pathways now allow student/teacher dialogue through various electronic interfaces, typically two-way audio and one-way video. The JCET states that Connecticut has not yet adopted a uniform system for provisioning of remote instructional programming, but instead has

23 Ibid., p. 4.
24 DPUC Feasibility Study, Docket No. 93-07-09, January 28, 1994, p. 7.
25 Ibid., p. 3.
26 1993 Annual Report from the Joint Committee on Educational Technology. Hartford, CT.: February 1, 1993. p. 3.

adopted a piecemeal approach, which has somewhat inhibited technological innovation. The JCET further believes that educational and information technology can remove many of the inequities now extant in the public school system, and they further suggest that emerging applications of educational technology such as the proposed statewide interconnection could attract much needed commerce to a state economy ravaged by the depressed insurance and defense industries and by the high cost of doing commerce in Connecticut. The JCET states: "The effective use and integration of educational technology will be a key factor in improving education and achieving equity..." The JCET further believes that the proposed interconnect is imminent, particularly with the recent designation of Hartford as a "superhub" or nexus in the $2 billion dollar nationwide TCI fiber optic wiring project. This work will result in approximately 1,100 miles of fiber in Connecticut alone, costing a projected $68 million dollars, and affecting virtually all of the state's 223,000 cable subscribers.[27] Part of that package will offer interactive educational services. Since costs for running the schools are supported by taxes, the extent and manner in which the DPUC ,may recommend the shifting of these programming and transmission costs from the general tax base to possibly the subscriber base, if at all, remains to be determined through the regulatory process. See, for example, the Department's position on the Connecticut Education Association (CEA) proposal, *passim*.[28] On the other side of the technological coin are the educational perenialists, who stress that solid pedagogy and a "back to basics" curricular thrust are what is needed to promote substantive and effective learning, rather than an overeliance on technology. This recently became an issue in the central Connecticut town of Southington, where school Superintendent Louis Saloom stated:

While we have been spending $350,000 over the last two years on computers, the funding in other areas of the budget has been eroded. We have done little or nothing with buying equipment. Our textbooks are out of date.

A statewide interconnection that is actually implemented is likely to spawn more policy than technical problems, especially in the crossing of disparate cable franchise boundaries. In Connecticut, both TCI and SNET are installing fiber optic cable. SNET's goal is to install fiber to connect every switching station in the state to

27 Susan E. Kinsman, "Hartford to be Hub in $2 Billion Fiber-Optic Project," The Hartford Courant, 150, (103), (April 13, 1993): A1.

28 DPUC Feasibility Study of Educational and Instructional Programming: Comments of Nutmeg Public Access Television Inc. New Britain, CT.: Department of Public Utility Control, Docket No. 93-07-09, p. 5.

nodes of 500 or more customers. Coaxial cable would then connect the nodes to individual homes or to businesses.[29] This arrangement will facilitate the offering of not only dial tone but of voice, video and data transmission as well, including remote educational applications. Regulators in Connecticut are moving away from the fixed rates of traditional rate-of-return regulation of return toward allowing regulated utilities more leeway in shifting their costs and in setting prices within certain limits. In SNET's case, the Company has recently allowed MFS Telecom to share a portion of its fiber-optic network and local telephone business in an effort to expand its existing 2,500 miles of fiber cable.[30] A recent proposal by the Connecticut Education Association (CEA) advocated that SNET contribute up to one-quarter of one percent of any of its overearnings to establish a statewide fund for educational telecommunications, a proposal that the Department ruled would better serve the public good after a legislative mandate for such a fund was established by the Connecticut legislature.

FEDERAL INITIATIVES

The primary reasons for the nationwide proliferation of remote educational paradigms is that essential educational needs can be fulfilled by the developing technology, and technology is becoming cheaper and less capital-intensive to implement.[31] On the federal level, the Department of Education's *"Star Schools"* grants program has allocated more than $100 million dollars to fund remote education programs in 47 states over the past several years, as well as establishing programs in Puerto Rico and in the Virgin Islands.[32]

Recent Connecticut legislation has attempted to foster the development of instructional programming and has included educational shows deemed by legislative act to be "technologically advanced...."to comply with quality of service standards."[33] Ultimately, the provisioning of two-way cable television service is one important

29 George Judson, "Data Highway Accelerates in Connecticut," The New York Times, 143, (49, 576) (January 14, 1994): B1, B4.

30 Kathleen Gorman, "SNET to Share Fiber-Optic Service," The Hartford Courant, 156, (January 18, 1994): D1, D5.

31 Isabelle Bruder, "A Guide to Distance Learning," Electronic Learning, 11, (3), (November-December, 1991): 20-28.

32 Linking for Learning: A New Course for Education. Washington, D.C.: Office of Technology Assessment, November, 1989. p. 15.

33 An Act Concerning Educational Programming. Hartford, CT.: Public Act No. 92-146, May 27, 1992.

regulatory objective. As suggested by a recent technical report on emerging communications technologies:

Cable operators will continue to spend significant amounts of capital on fiber optics, but not on digital compression..." [34]

However, that technology has still not saturated the franchise territories, nor is it technologically feasible until system channel capacity needs to be greatly expanded, usually well beyond the usual 60-70 channel average system size. [35]

The recent proliferation of interactive services has resulted in:

....delivery of movies on demand, home shopping, interactive pay-per-view, educational programming, medical diagnostic services, games, data service and electronic libraries."[36]

Digital video signal compression will eventually become a routine tool as the signals are compressed and transmitted without noticeable distortion, and the refinement of the processing will eventually decrease interactive costs as transmission capacity is enhanced, as more and more channels are squeezed into the traditional MHz single channel bandwidth.

Despite the copious amount of federal and state legislation spurring the evolving electronic information superhighway, schools must still contend with such time-honored problems as unwieldy class sizes and a shrinking educational largesse; not every school will have the funding and the access to support the latest electronic learning protocols, particularly in Connecticut's devolving economy. In these cases, the textbook rather than the computer terminal will remain the dominant learning modality

34 James O. Farmer, "Analog vs. Digital: The Basics," Communications Technology, (July, 1994): 26-30.

35 George Lawton, "Building the Ubiquinetwork-Part 1," Communications Technology, (March 1994): 25-32.

36 Brian Miller, "The Great Equalizers: Libraries and Internet Access," Government Technology, 8, (August, 1995): p. 34.

as being the cheapest way of getting into a student's hand and head what is needed to be learned.

On the other hand, core disciplines such as medicine and science have embraced the developing electronic learning paradigms wholeheartedly to cut the rather substantial costs of medicine by transmitting the expertise of expensive specialists to geographically isolated and rural areas of the country.[37] Recently, the information monolith *Encyclopedia Britannica* has begun computerizing its product . The Company has come to realize the limitations of hard-bound volumes and is entering the electronic publishing market to determine what are the largest and most lucrative information markets. This represents a significant move toward instant knowledge. *Britannica's* move is significant because it represents the use of what is essentially an electronic learning paradigm to tap such advanced Information Age modalities as "hypertext," which allows each referenced article to be instantly referred to other germane works and illustrations, and also connects the four primary components of the encyclopedia: *macropedia*, *micropedia*, *index*, and an outline of world information called a *propedia*. Traditional texts cannot offer such informationally "smart" capability, although they cannot be matched for accessibility and for easy dissemination of content area material. Larry Smarr, Director of the National Center for Supercomputer Applications states:

Here is a whole world of people who are using as "cyberspace" as their information stream. They are all potential customers for commercial information providers.[38]

The technological upheaval has fanned the flames of the educational futurist crowd, while inciting a reactionary response from such "nostalgic" conservatives as former U. S. Education Secretary William J. Bennet. The technocrats, on the other hand, believe that society should not want things as they were, but rather as they could be in an efficient, highly technologized society. It remains for each individual to decide which direction to take in the wake of social technologization.

While it remains technologically feasible to proffer interactive instructional learning, the costs to Connecticut's cable franchise operators remain prohibitive.

37 Andrew Purvis, "Healing by Wire," Time, 139, (20), (May 18, 1992): 68.
38 John Markoff, "Britannica's 44 Million Words Are Going On Line," The New York Times, 143, (49, 601), (February 8, 1994): D1, D2.

Evolving technologies such as digital signal compression and high-tech system architecture such as ISDN are theorized to drive down instructional programming costs eventually. However, questions regarding usage, operation, and maintenance costs, cost allocation, and sources of funding must be thoroughly analyzed as a necessary prerequisite to the establishment of statewide remote educational network in Connecticut, or to interconnect the various institutional networks.

TECHNOLOGICAL INNOVATIONS

It is noteworthy to observe the change that technology has wrought in distance education, from its inauspicious beginnings as correspondence courses in the early nineteenth century to a learning modality now considered to be de rigueur in many learning environments across the country. Connecticut's emerging regulatory framework supporting distance education is a cautious first step in moving from its present multifaceted approach toward achieving a more unified paradigm. The actual modus vivendi is telecommunications deregulation. Philosophically, technology being used to promote remote education may also be viewed as a social contract in that leading edge technology is the means to produce and to disseminate a service to benefit the common good of the whole society. As the Enlightenment philosopher Jean Jacques Rousseau stated:

What a man loses by the social contract is his natural liberty and an unlimited right to do everything he tries to get and succeeds in getting; what he gains civil liberty and the proprietorship of all he possesses.[39]

The Department has suggested that the cable and telephone industries should play a part in the provisioning of a statewide distance education network. Connecticut cable officials however, quickly admonish against constructing an expensive system without usage assurances in place from the local educational communities. Cable representatives expressed concern that building interactive architecture without such assurances from potential users may lead to a situation analogous to Iowa, where a costly, $100 million dollar, 2,800 mile fiber optic backbone, statewide remote education

39 Jean Jacques Rousseau, On the Origin of Inequality of Political Economy: The Social Contract. G.D.H. Cole, trans., Chicago: Encyclopedia Britannica, Inc., 1952. pp. 393-94.

interconnection has been established, but has ostensibly suffered from a dearth of educational and instructional programming usage, which in turn, has had a deleterious impact on the state's general fund of operating the costly educational network.[40] In Connecticut's case, the question of whether such an investment should be made has already been answered affirmatively. The next question must be asked to determine who should make it. The beginning deregulation of various communications service providers, the emergence of competitive access providers, competition itself, the easing of federal cable-telco cross-ownership restrictions, and private investment are theorized ultimately to be the mechanisms that will fund the developing electronic pathways.[41] Government in and of itself, however, be it federal, state, or local, cannot accomplish that task.

Local Exchange Carrier Initiatives

As digital and fiber optic technology have evolved, both the local exchange companies and the cable franchise operators have been moving toward a common objective of constructing and of implementing two-way interactive networks offering voice, video, and myriad data communications options.[42] SNET has set up *Operation WIN Connecticut* in an effort to compete with Interexchange carriers like AT&T to offer public and private schools specially discounted rates to wire classrooms for computers, voice mail, and to the InterNet. It makes sense to combine cable and telephone technologies, since the former are essentially gigantic one-way pipelines into the home capable of enormous processing capacity, while the latter possesses the switching and linking ability necessary to bring about ease of data transmission. The advent of the Information Age may in fact change the prevailing educational metaphor from the textbook to the computer screen, just as the computer revolution helped change the image of America from the land of the smokestack economy to the land of the cathode ray tube display. The raison d' etre of distance education is that learners of all ages, be they administrators, teachers, students, machinists, or politicians will be provisioned with information and mail from across the nation, state, and district sans costly connect charges, making the equity of informational access more feasible by linking users to the

40 William Fulton and Morris Newman, "Who Will Wire America?" Governing, 7, (1) (October, 1993): 26.
41 Mitchell W. Pearlman and Colleen M. Murphy, "Will Access to Information Be Universal?" The Hartford Courant, (January 30, 1994): E1, E4.
42 Edmund L. Andrews, "From Sibling Rivalry to Civil War," The New York Times, (November 28, 1993): 3, 1, 6.

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network with only a local telephone call. Particularly in a regulatorily progressive state such as Connecticut where the franchising authority regulates the operators directly, emerging franchise operators can avoid the municipal disputes that can occur and waste time. Cable television companies will continue to evolve into competitors of telephone companies as competitive service providers, and this will include remote educational services.[43] Inter and intrastate remote education networks are likely to increase as the National Information Infrastructure Act encourages both telephone and cable companies to build high-speed fiber optic networks. Trade groups such as the National Cable Television Association want to exclude telephone companies from entering the cable television market for at least a few more years, and the recent failure of the TCI/Bell/Bell Atlantic mega-merger may mean that the panoply of wire and wireless services, video-on-demand, interactive multimedia and other "information superhighway" services will most likely be placed on hold.[44] Because of that failure, it remains to be seen to what extent and in what manner the National Information Infrastructure Act will result in an interconnected, interactive nation or, on the other hand, may result in the establishment of a vast, electronic wasteland where voice mail, automatic call routing, electronic mailboxes, multiline fax machines and caller ID could conceivably lead to an environment where rather than connecting, messages get lost or avoided more easily than ever.[45]

It also remains to be seen, in light of the TCI/Bell Atlantic failure, where the huge amounts of capital needed to realize the national information superhighway will now materialize.[46] Connecticut recently accomplished an important distance education objective when the Department adopted distance education and instructional programming as state regulations. The law states:

The Department may renew a franchise.... if the franchise holder has committed itself to maintain technologically advanced equipment and facilities, comply with quality of

43 Paul F. Kirvan, "Divestiture: Its Impact on End Users," Communications News, 31, (1), (January 1994): 11-13.

44 Geraldine Fabrikant, "Merger Talks Halt on $33 Billion Deal in Communications," The New York Times, 143, (49,617), (February 24, 1994): A1, D6.

45 Kirk Johnson, "Banishing the Busy Signal," The New York Times, 143, (49,587) (January 25, 1994): B1, B6.

46 Floyd Norris, "Malone Knows: Cable Has a Rocky Future," The New York Times, 143, (49,620), (February 27, 1994): III: 1.

service standards as determined by the Department and make available the facilities and equipment necessary to enhance and promote educational programming.[47]

The regulations, intended to bring the Department into compliance with Public Act 92-146, require the franchising authority to consider the cable operators' commitments to identifying, adumbrating, and for implementing quality criteria for instructional and for educational programming. Cable franchise holders must now specify to the Department to what extent and in what manner they will address not only the public, educational, and governmental access needs of their subscribers, but to what extent the operator will address the instructional programming needs of the franchise community. This regulatory framework provides a platform on which the franchise community can construct the foundations for its distance learning and instructional programming needs. Whether these needs are articulated to the operator via cable company advisory councils, by educational communities of interest, or by Boards of Education, the result is what is important-namely, that the franchise community has a mechanism with which to communicate to its franchise holder a "critical mass" of support for its educational and instructional programming and its policy objectives. Connecticut franchise operators already are re-configuring their system architectures to eventually replace coaxial cable with more capacious fiber to effectuate future interactive capability, particularly for educational and for instructional programming protocols that ideally require two channels.

Lastly, the advent of actual cable franchise competition has arrived with the Department's recent granting of the state's first Certificate of Public Convenience and Necessity to a cable operator to compete directly with an existing franchise operator, and with the extant video dial tone trials in West Hartford and in Fairfield County. FiberVision of Greater Hartford, Inc., received approval from the DPUC to construct a fiber optic system and compete with a TCI Cablevision affiliate to offer cable television service. Although the Department has had authority since 1985 to allow competing cable operators to proffer service in the same markets, FiberVision's approved application is the first successful attempt by a Connecticut cable operator to construct a system in another operator's service territory and thus compete directly with the existing franchise holder for the provisioning of services.[48] The Department awarded

47 "Quality Standards for Instructional and Educational Channels." Connecticut Law Journal, 225. (May 18, 1993): 21B, 22B

48 "Final OK for Cable Competition," The New Britain Herald, 39. (February, 16, 1994): 1, 13.

FiberVision a 15 year franchise term to construct an 1,110 mile cable system serving six towns. Additionally, FiberVision intends to link schools and libraries in its franchise area with the capability of an interactive educational network, which would offer the educational institutions options of simultaneous narrowcasting of various courses. Such a scenario would ultimately result in enhanced pedagogical opportunities throughout the franchise territory through the usage of the proposed institutional network.[49] Additionally, the FiberVision approval heralds in a concerted technological rush to the Hartford area, as SNET has recently finalized plans to construct its $4.5 billion fiber network over fifteen years, the goal being to connect all Connecticut homes to it by 2009. The Company is also offering interactive television service which will be offered through a one-year, video-on-demand market trial in the suburb of West Hartford.[50] That trial, recently approved by the FCC, will be extended into other areas of the state for one year, as FCC approval of the expansion allowed. The trial differs from traditional pay-per-view in that consumers may set their own viewing schedules. Video-on-demand, one of the so-named "information superhighway" services, will be offered at rates alleged to be comparable with cable television rates. A local television station will "time-shift" news programming, enabling customers to watch the most recent news broadcast when they want it.[51]

CONNECTICUT SPECIFIC INITIATIVES

Connecticut is thus well-positioned to fit into the evolving parameters of the emerging remote educational Infrastructure framework that will eventually connect homes, businesses, and various educational communities in a vast electronic, multimedia and informational network infrastructure.[52] Educational groups such as the JCET hope that the state can ultimately effectuate a distance education paradigm such as Thomas Edison State College in New Jersey, where a Vax 4000 mainframe

49 Application of FiberVision Corporation of Greater Hartford to Provide Community Antenna Television Service. New Britain, CT.: Department of Public Utility Control, Docket No. 93-07-04, October 4, 1993. p. 1

50 Kirk Johnson, "Connecticut Approves Cable Battle," The New York Times, 148, (49,610), (February 17, 1994): B1, B10.

51 Kathleen Gorman, "Choosing a Flick Via a SNET Hookup," The Hartford Courant, 156, (54), (February 23, 1994): C11.

52 "Vice President Gore Outlines Administration's Telecommunications Policy," Infotrack, 3, (1), (January, 1994): 1.

computer helps adult learners too busy with careers and with families to learn the content material necessary for professional development and advancement. Funding is available to supply needy students with a modem and with a Vax 4000-compatible computer to participate in the program. Learners, with those tools, are then able to use ordinary telephone lines to gain access to the educational process.[53] William J. Seaton, Thomas Edison State's Director of Adult Education, states:

"Interaction, like the ability to hold class discussions by computer, breaks down the isolation of long-distance learning."[54]

Incipient federal legislation postulates a regulatory architecture for allowing long-distance and local telcos to compete head-on, and with that direct competition will come even more interactive capability for cable franchise operators as more fiber optic and hybrid networks are constructed. Connecticut itself is the first state to open up the local market to intrastate competition.[55] Despite the heavy media attention however, Connecticut regulators are attempting to avoid turning distance education into a son et lumiere. Professional education organizations such as Minneapolis based Educational Alternatives Inc. (EAI) are attempting to privatize and technologize poor and failing urban school systems such as in Hartford and in Baltimore, Maryland. The Company, which went public in 1991, had revenues of $30 million for the previous fiscal year, is vehemently opposed by teachers' unions, because it has replaced unionized teaching personnel with its own technical and support staff. Despite the opposition, the company has recently received municipal approval to run Hartford's entire 32 public schools system. Professional educators claim that EAI is short on sound pedagogy and long on techno-gadgetry and gimmickry, and does not adequately address the needs of special education students. In any event, distance learning applications figure prominently in the company's teaching paradigm and learning approaches.

CONCLUSIONS/NEW GUIDELINES

53 John Nordheimer, "Computers and Phones Pave New Path," The New York Times, 143, (49,614), (February 21, 1994): B1, B5.

54 Ibid., p. B5.

55 Anthony Giorgianni, "State First to End Local Phone Competition," The Hartford Courant, 157, (355), (December 21, 1995): A1, A14.

The federal government so far has managed to connect some schools, libraries, hospitals, and municipalities to the existing interactive technologies, but has not specified how it will connect private citizens, if at all.[56] Recently announced interactive joint ventures, such as the one engineered by Walt Disney, Inc., along with three Regional Bell Operating Companies have made provisions to carry educational programming, and the Federal Communications Commission Chief Reed E. Hundt has publicly espoused his intention of forcing, if necessary, cable companies to carry at least three weekly hours of educational programming.[57] No agreements have currently been reached on this inflammatory social issue. Connecticut is now at the point where rhetoric comes face to face with engineering realities, as the information networks are being constructed and connected. Connecticut's remote educational protocols have filtered down to elementary school levels, as evidenced by the recent proliferation of programs such as the one in Southington, where second graders have used computers to assist in their learning of the writing process.[58] Public and private schools across the United States are relying heavily on telecommunications technology to proffer distance learning.[59] Eight years ago, for example, fewer than ten states in the continental U. S. had functioning remote educational protocols; today, nearly every state has some type of functioning remote educational program.

To summarize, Connecticut is on the fast track, both legislatively and technologically, to develop what ultimately will become a ubiquitous distance learning network. In the summer of 1993, for example, 34 Connecticut college and public libraries in the Hartford region abandoned their traditional card catalogues for *CARL*-Colorado Alliance of Research Libraries.[60] Connecticut's public libraries, schools,

56 Philip Elmer-DeWitt, "Play...Fast Forward...Rewind...Pause," Time, 143, (21), (May 23, 1994): 44-46.
57 Geraldine Fabrikant, "Disney to Sample the Interactive Era," The New York Times, 143, (49, 783), (August 9, 1994): D1, D17.
58 Carolyn Moreau, "Southington May End Computer Writing Program, " The Hartford Courant, 157, (360) (December 26, 1995): B1.
59 Brian Miller, "Distance Learning: Much Closer," Government Technology, 8, (7), (July, 1995): 18-19.
60 Fran Silverman, "Librarians Find New Life for Old Symbol of Information Highway," The Hartford Courant ,157, (37), (February 6, 1995): A3, A8.

colleges, and universities are all merging their information technologies to create an information-friendly society.[61] It is evident from even a cursory glance at Connecticut's information infrastructure that the incipient competitive communication scenario will unfold with companies competing to deliver telephone, cable, computer, and electrical services.[62] With the coming of the $4.5 billion *I-SNET*, the fiber-optic superhighway will function to supply people with more informational choices. As the state's Consumer Advocate recently stated:

> Theoretically, it {competition} should be good for the {Connecticut} consumer, if there is more competition and more choices....But nobody can tell you that for sure now. It is a very complex issue. It depends on how the implementation of the developing legislation shakes out. [63]

As more of the state's public libraries become computerized, greater numbers of residents will be able to expand their individual educational choices, in cases where the person owns a computer and a modem, simply by calling a direct number from home to find out what library resources are extant.[64] As Connecticut's schools and libraries expand their informational resources, the race to see who will deliver the next set of emerging interactive services will remain in full force as the coming millennium unfolds. It remains to be seen to what extent and in what manner cyberspace will supplant physical space, may eliminate direct human contact, and whether this will result to any extent in spiritual isolation as the technocrats take the country on what some have said may very well be a reckless ride into the unknown.[65] Until then, the state will see the installation of more computers in public school classrooms, increased networking of schools with municipal agencies, and more instant access to public library catalogues. The amount of funding required by the local educational communities to realize these

61 Michelle Tuccitto Balcom, "Library Conducts Tours along Internet," The New Britain Herald, 26. (November 26, 1995): A7.
62 Eve Nagler, "Mapping Telephone's New Uses," The New York Times, 144, (49, 830), (September 25, 1994): 13:1, 17.
63 Ibid., p. 17.
64 Melissa Miller, "Library Goes On-Line: Town Gets Home Page," The New Britain Herald, 310. (December 30, 1995): A8.
65 Mitchell Heim, "The Metaphysics of Virtual Reality," New York: Oxford University Press, 1993. pp. 99-102.

remote learning models remains to be seen, and the Department's position on distance education will continue to evolve commensurably with these protocols and with the technology.[66]

Lastly, the Connecticut Department of Education's recent issuance of *Guidelines for Educational Technology Standards for Connecticut Schools*, slated to be distributed to all school districts in early 1996, will finally establish sound official guidelines to limn the appropriate uses of school technology for school personnel, something Connecticut has never before had. As a recent executive summary of those guidelines stated:

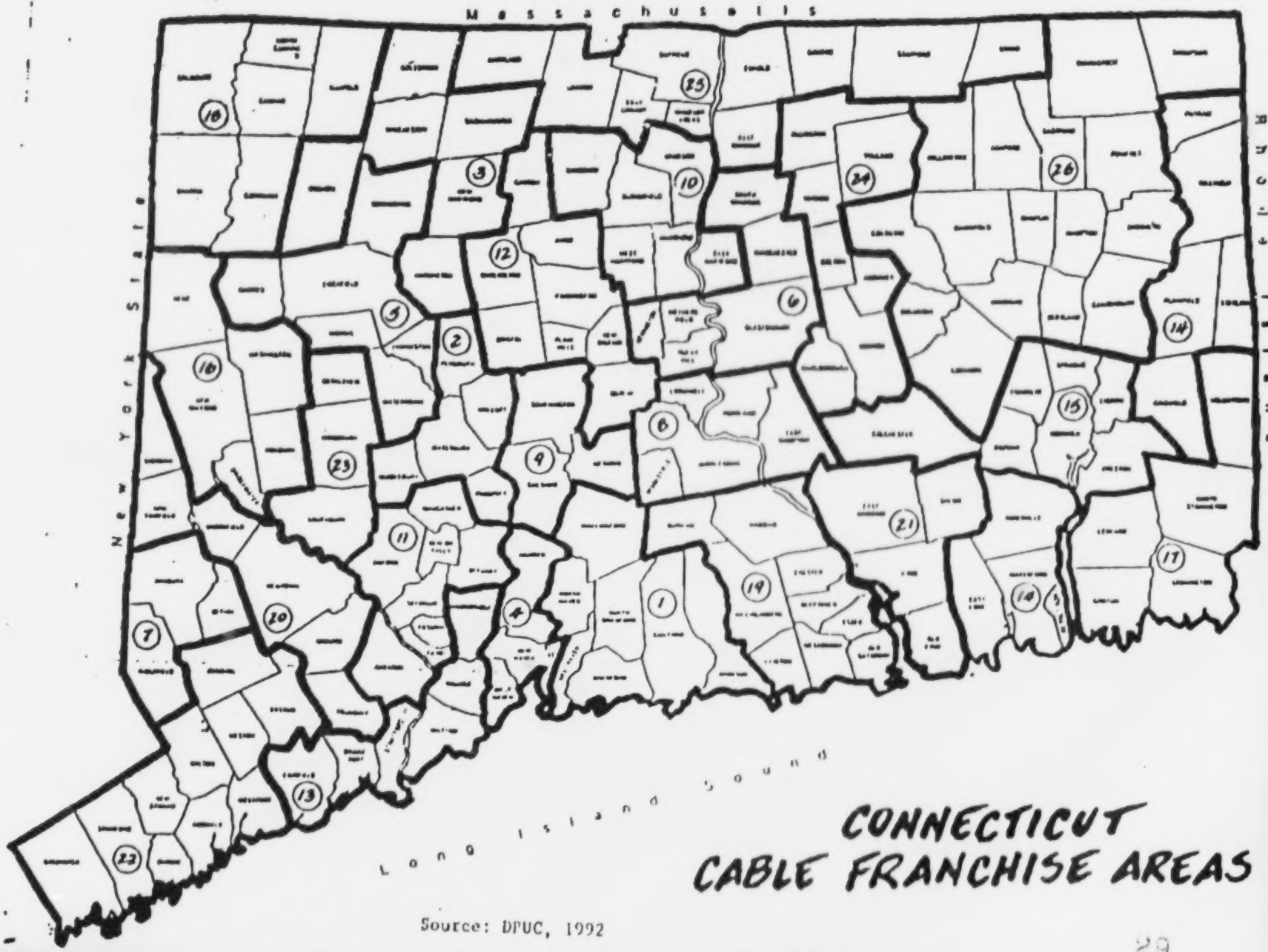
....There are Connecticut schools using educational technology in a variety of ways....There has been no broad-based application of technology or infusion of financial support for the major renovations that are often necessary to fully integrate educational technology into teaching and learning on an equitable basis throughout the state....The purpose of this document is to provide educators and architects with the technical standards for providing video, voice, and data communications capability in every {Connecticut} classroom and to establish a framework....to plan the effective use of educational technology. Technology is not an end in itself....[67]

Connecticut is thus well-positioned for equitable access to information technology for administrators, teachers, students, and parents, which in turn will be a key factor in reversing the state's downward economic spiral, its anemic economy, and for developing a technologically literate populace for the new century.

66 Tracie Mauriello, "Board Oks $8.6 Million Computer Plan," The New Britain Hérald, 246, (October 17, 1995): A3.

67 Richard S. Krissinger, Draft Guidelines for Educational Technology in Connecticut Schools. {Executive Summary} (January 5, 1996) Hartford, CT.: Dept. of Higher Education, School Facilities Unit.

TABLE A



CONNECTICUT
CABLE FRANCHISE AREAS

Source: DPUC, 1992

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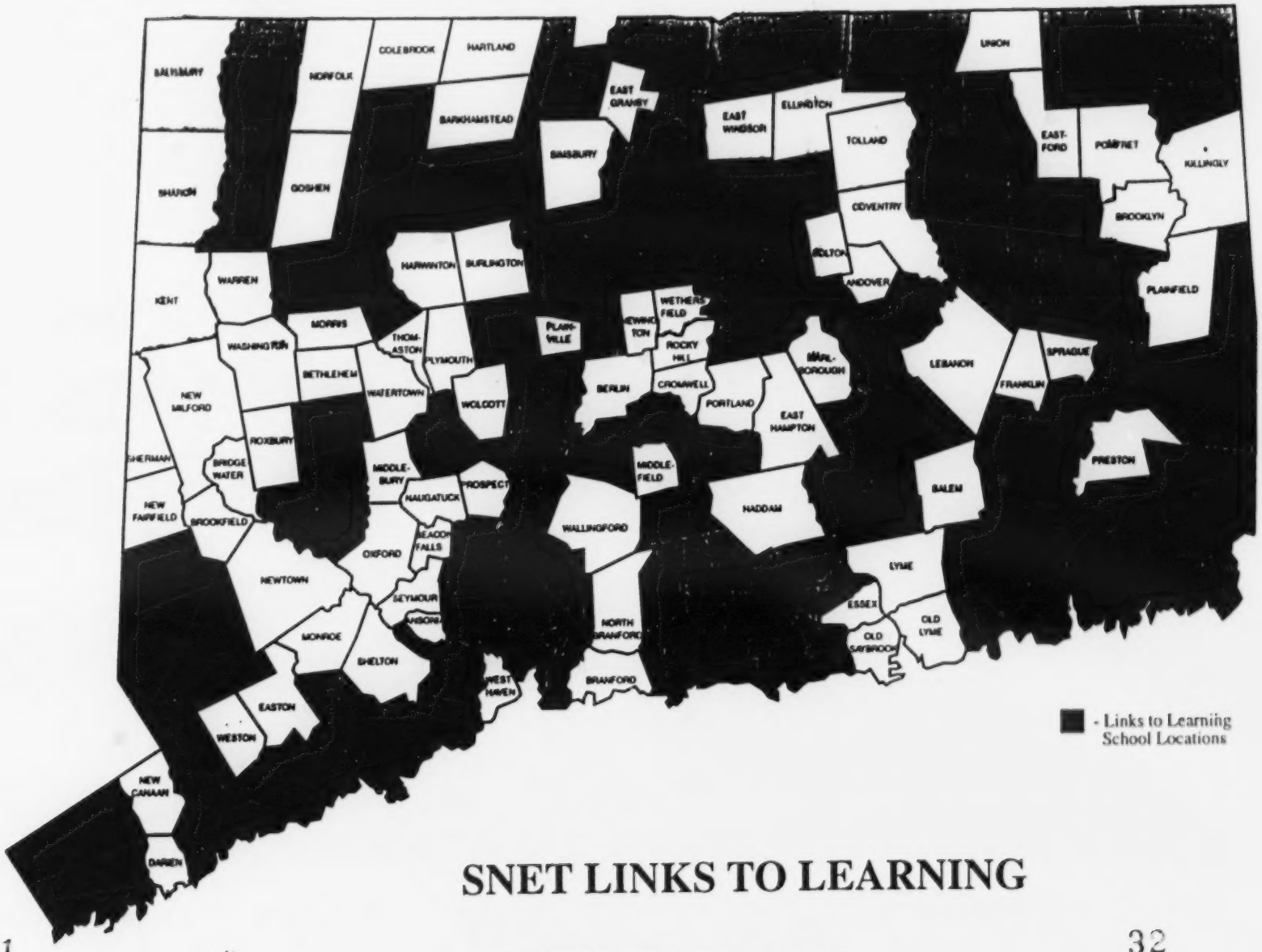
Legend To Table A

Cable TV Company Name	Company Number
TCI Cablevision of South Central CT	1
Sammons Communications	2
Pegasus Cable Television	3
Storer Communications of Groton	4
Laurel Cablevision	5
Cox Cable of Greater Hartford	6
Comcast Cablevision of Danbury	7
Comcast Cablevision of Middletown	8
Telesystems of CT	9
TCI Cablevision of Hartford	10
Tele-Media of Western (Valley)	11
TCI Cablevision of Central CT	12
Cablevision of Southern Connecticut	13
Eastern Connecticut Cable Television	14
Century Norwich Corporation	15
Crown Cable New Milford	16
Storer Communications of Groton	17
TCI Cablevision of Northwestern CT	18
Storer Communications of Clinton	19
Crown Cable-Housatonic	20
Century Cable Management Corporation	21
Cablevision of Connecticut	22
Crown Cable Mid-CT	23
TCI Cablevision of Eastern Connecticut	24
Continental Cablevision	25
Tele-Media of Northeastern CT	26

Source: DPUC, 1993

TABLE B



SNET LINKS TO LEARNING

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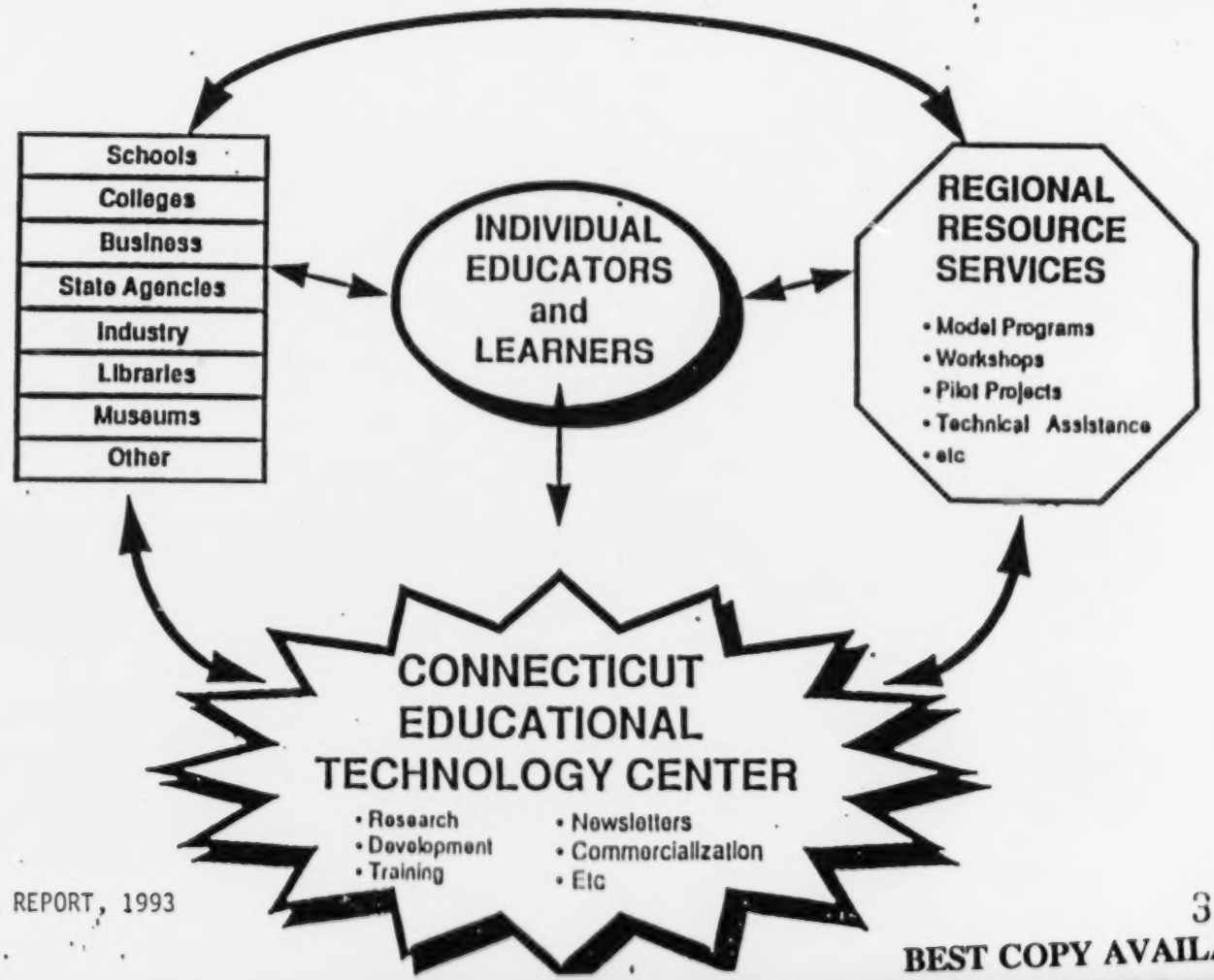
TABLE C

CONNECTICUT EDUCATIONAL TECHNOLOGY PROPOSED INFRASTRUCTURE



SOURCE: JCET ANNUAL REPORT, 1993

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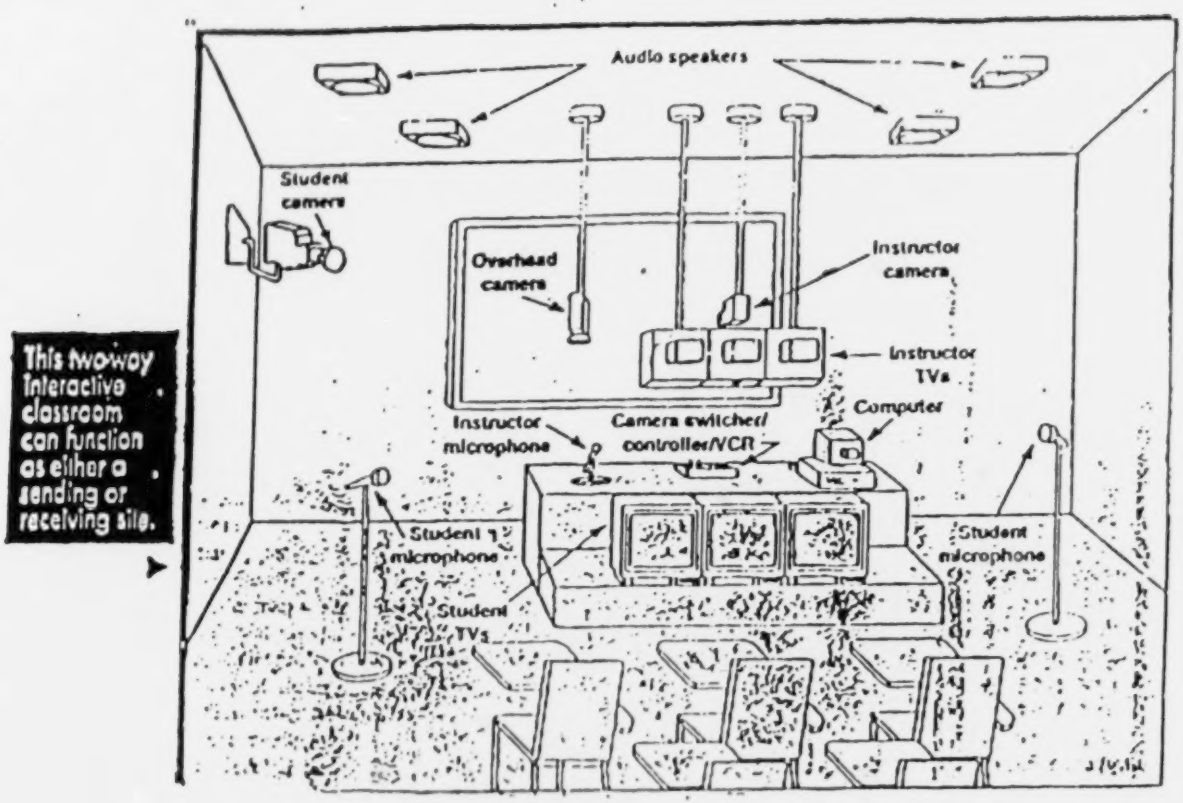
TABLE D



Source: Linking for Learning, Office of Technology Assessment, 1991.

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